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Massachusetts' Return on Investment: A Gap Funding Model for Success

THANKS TO A GAP FUNDING PROGRAM OFFERED THROUGH A PARTNERSHIP OF MASSACHUSETTS GOVERNMENT AGENCIES, WATER AND WASTEWATER FACILITIES HAVE OVERCOME FINANCIAL AND OTHER RESOURCE BARRIERS AND ARE IMPLEMENTING CLEAN-ENERGY PROJECTS.

Maximizing returns on investments and reducing operating costs—every business and government agency should strive for these goals. This article describes a "gap funding" grant approach that promotes clean and efficient energy, benefits air quality, and effectively reduces energy and operating costs at public drinking water and wastewater facilities across the Commonwealth of Massachusetts. Without it, utilities would face barriers and miss opportunities to implement beneficial projects.

Serving as a model for collaboration and innovation, Massachusetts government agencies have successfully delivered both returns and efficiencies to municipal water ratepayers under the Clean Energy Results Program (CERP). CERP is a government-led, statewide partnership of the Massachusetts Department of Environmental Protection (MassDEP), the Massachusetts Department of Energy Resources (DOER), and the Massachusetts Clean Energy Center (MassCEC). This program helps meet joint environmental protection and energy goals by advancing the deployment of renewable energy

and energy efficiency projects. (More will be said about CERP later in this article.) Program resources from Mass Save®—an initiative sponsored by Massachusetts' private natural gas and electric utilities and energy-efficiency service providers—are effectively leveraged with public resources. The results: cost-effective energy and environmental benefits for the public. Clean and efficient sources of energy can improve air quality, address climate-change issues, and save significant costs for utilities. It doesn't get much better than this—it's an economic and environmental win.

Drinking water and wastewater facilities are dealing with infrastructure that is at the end of its design life or useful life. They are facing more regulatory requirements and increasing customer expectations as well as strained municipal budgets. It is critical, therefore, to reduce or avoid operating costs while maintaining compliance. This can be done with a gap-funding financial assistance model, which allows facility managers to build credibility with their governing directors, boards, commissioners, the general public, and—most importantly—their ratepayers. Utilities can put the operational cost savings back into their infrastructure and assets.

BUILDING THE CORE PARTNERSHIP

Whether you're in the private or public sector, developing a new way of doing business to meet customer needs is not easy. For MassDEP, for example—a state public government agency whose 40-year roots were built on traditional regulatory oversight, environmental permitting, facility compliance, and enforcement—changing its regulatory mindset to meet the energy and environmental needs of the 21st century began with a new partnership model.

How did the Commonwealth of Massachusetts create its gap funding approach? It came about through an evolution of collaborations. The Massachusetts Executive Office of Energy & Environmental Affairs and MassDEP set out to identify how the state could achieve a higher level of energy efficiency at water and wastewater utilities. Thus, the foundation for the present-day partnership was established, with the December 2007 launch of the Massachusetts Energy Management Pilot for Drinking Water and Wastewater Treatment Facilities. Partners in the pilot program were the US Environmental Protection Agency (USEPA)–New England, DOER, University of Massachusetts Amherst (UMass Amherst), Massachusetts Technology Collaborative, Consortium for Energy Efficiency, Cape Light Compact, and major energy utilities including National Grid, NStar, Unitil, and Western Massachusetts Electric Company (which has since merged with NStar under the utility Eversource).

The partners in the Energy Management Pilot broke down organizational silos and provided a total of $326,000 in energy assessment services. The initial 14 participating municipal drinking water and wastewater utilities received energy audits from private investor–owned energy utilities, onsite energy feasibility assessments from UMass Amherst and the Massachusetts Technology Collaborative, and energy performance benchmarking from USEPA–New England. Designed to voluntarily reduce emissions of greenhouse gases and energy use by 20%, the pilot program identified a potential $3.7 million in annual energy savings across the 14 facilities with potential onsite renewable energy generation of over 7 MW (NSCEP 2009). After providing the energy assessment services, these projects were implemented using funds from the 2009 American Recovery and Reinvestment Act.

Building on the work of the Energy Management Pilot, the Massachusetts Clean Energy Partnership for Wastewater and Drinking Water Facilities was created by MassDEP, DOER, University of Massachusetts Lowell, and USEPA–New England in 2008. The Clean Energy Partnership targeted reductions in energy use, costs, and greenhouse gas emissions in wastewater and drinking water operations. From early 2008 through 2014, one-third of the state's 250 drinking water and 120 wastewater municipal facilities or districts participated in the Clean Energy Partnership's programs as "energy leaders." The Clean Energy Partnership

- saved Massachusetts communities over $35 million through reduced energy demand and generation;
- reduced electricity consumption by approximately 240,000 MW·h;
- removed more than 100,000 tons of carbon dioxide (all voluntary and all without new regulations); and
- increased, statewide, total operating onsite generation by 27.6 MW from 2007 to 2014—a 173% increase from the existing baseline of 16 MW pre-2007. (An additional 9 MW of generation is under development which, when completed, will result in more than 52 MW of installed capacity statewide; see Figure 1).

> Various incentive programs partially supported clean energy projects, but a financial gap frequently prevented the many facilities from implementing the recommended improvements.

The Clean Energy Partnership's collaborative model has been successfully replicated across the six New England states and in 15 other states and US territories. It was named as one of five finalists in the 2015 Innovations in American Government national competition sponsored by the Harvard Kennedy School's Ash Center for Democratic Leadership. The Clean Energy Partnership also received a Leading by Example award in 2015 from the Commonwealth of Massachusetts for outstanding energy and environmental efforts (Snow et al. 2016).

REMOVING BARRIERS WITH THE GAP FUNDING MODEL

During MassDEP's eight-year partnership with municipal facilities in Massachusetts, it became clear that many facilities had completed energy audits—some of them multiple audits through their energy utility companies going back years, with significant opportunities for energy improvements—but they were never implemented. Instead, many audits were collecting dust on the shelf. The big question was, how could the Massachusetts government move these energy-saving projects off the shelf and get results?

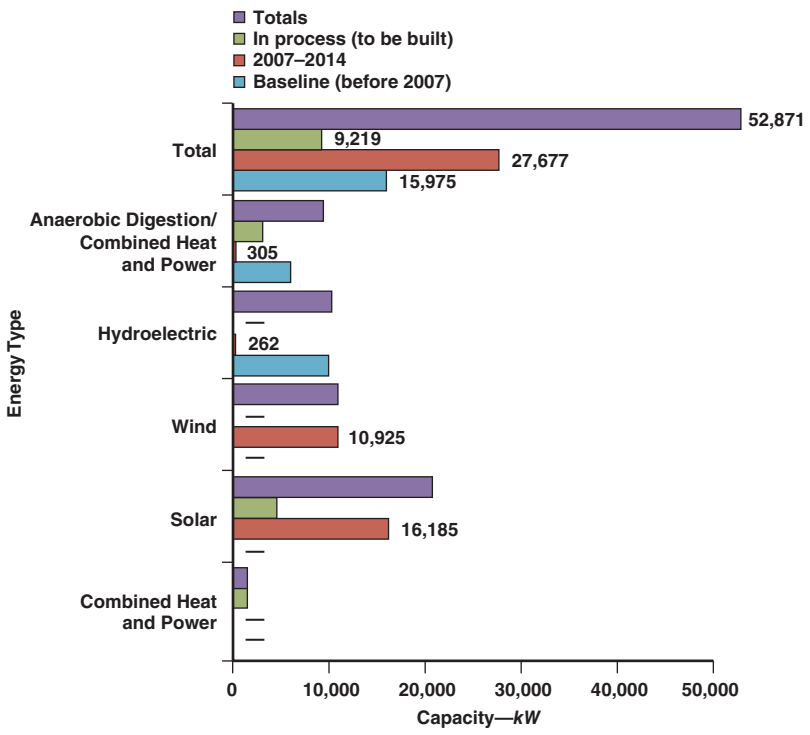
Although Massachusetts saw more than one-third of its drinking water and wastewater facilities become energy leaders working toward energy-saving goals, barriers remained to implementing widespread sustainable clean and efficient energy projects. These barriers included staff time and energy expertise, water treatment priorities, lack of surplus operating and capital funds for implementing energy-saving project opportunities, and the need to limit the number of funding and financing requests proposed to ratepayers.

Various incentive programs partially supported clean energy projects, but a financial gap frequently prevented the many facilities from implementing the recommended improvements. As a result, many promising energy-saving projects did not go forward. Instead, funding requests were delayed and made in response to an emergency, a regulatory requirement, or large infrastructure projects. By delaying action, many water utilities in Massachusetts were missing an opportunity to reduce their energy use and costs, operating costs, and carbon footprint. By 2014, MassDEP realized that if it could cover this upfront financial gap by connecting and leveraging energy utility incentives with some state funds, facilities could quickly implement their energy-saving projects and reap the benefits.

In 2011, MassDEP launched CERP. This innovative program was created to strengthen the environment–energy connection in Massachusetts by bolstering MassDEP and DOER's efforts to reduce regulatory and other barriers to clean and energy-efficient development across the state. In 2014, CERP addressed the financial and implementation barriers that water utilities were facing. MassDEP and DOER, with $1.7 million of funding support provided by the Regional Greenhouse Gas Initiative (RGGI) proceeds from MassCEC, and by alternative compliance payments (made by retail electric suppliers to meet their obligations to comply with the Massachusetts Renewable Portfolio Standard and Alternative Energy Portfolio Standard regulations) from DOER, created a new gap funding approach to jump-start and implement both energy efficiency and clean energy projects at facilities.

DOER and MassDEP had four goals:

FIGURE 1 Clean energy installed capacity at Massachusetts drinking water and wastewater facilities



Combined heat and power systems use a heat engine or a power-generating station to generate electricity and useful heat at the same time. It is also known as cogeneration.

- Expedite the installation of clean energy projects that would produce significant cost savings that can be reinvested into facilities' assets.
- Promote a model of collaboration between many partners to leverage all available funding sources for clean energy development.
- Address the challenge of funding smaller clean energy projects that have a cost too large to cover with an operating budget but are too small to warrant financing.
- Provide additional financial incentives for larger clean energy projects requiring financing through a competitive award process.

This financial assistance program was designed with a streamlined application process (a simplified two-page, online grant submission) that enabled quick implementation of previously assessed, but stalled, efficiency and clean energy generation projects. There were two funding pathways for applicants: (1) projects equal to or less than $100,000, which were evaluated on a first-come, first-served basis, and (2) projects greater than $100,000, which were evaluated on a competitive basis with ranking criteria.

STATE INVESTMENT MOVES ENERGY-SAVING PROJECTS FORWARD

In June 2014, the Commonwealth of Massachusetts awarded more than $1.7 million of the state gap funding grant to help fund 30 clean-energy and energy-efficiency projects at 21 drinking water and wastewater facilities. This innovative funding leveraged more than $2 million in energy utility incentives to produce nearly $11 million of clean energy improvement projects. This program required the facilities to contribute a minimum cost share of 10% of the total project costs.

This grant program made possible the implementation of energy efficiency and clean energy generation projects that had been previously assessed and recommended. It included two tracks: a "competitive track" that provided more than $1 million to five efficiency and renewable projects, and a "less than $100,000 track" that provided $0.7 million to 25 projects on a first-come, first-served basis.

> Clean and efficient sources of energy can improve air quality, address climate-change issues, and save significant costs for utilities.

The grants connected a variety of funding sources, including incentives from the Mass Save and municipal lighting plant energy efficiency programs. Other grant programs, such as the DOER's Green Communities Designation and Grant Program, also contributed funds. (The Green Communities Division helps participating cities and towns find clean energy solutions that reduce long-term energy costs and strengthen local economies.)

Each of these public funding sources ultimately derives from electricity ratepayers through the RGGI assessed on electric generators and the system benefit charge assessed upon electricity rates. Many states have similar funding sources that could potentially be leveraged and drawn upon. Figure 2 shows the anticipated annual cost savings for facilities and the summary of funding sources; Figure 3 highlights the anticipated cost savings and funding by the individual projects.

Cumulatively, approximately 15.7 MW·h in annual electrical savings and generation are anticipated, along with nearly 618,000 therms of natural gas savings through energy efficiency implementation. These projects are anticipated to reduce enough electricity to fully heat and power 897 Massachusetts homes every year for nearly 15 years. The resulting avoided greenhouse gas emissions is equivalent to removing 5,369 cars from the road for those 15 years. Figure 4 shows the total amount of anticipated electricity savings from energy efficiency implementation and the anticipated onsite electricity generation summary from installing

FIGURE 2 Total annual cost savings and grants

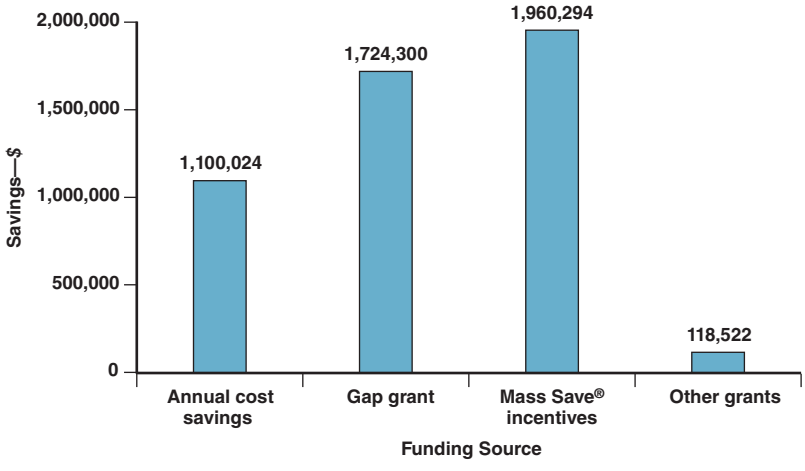
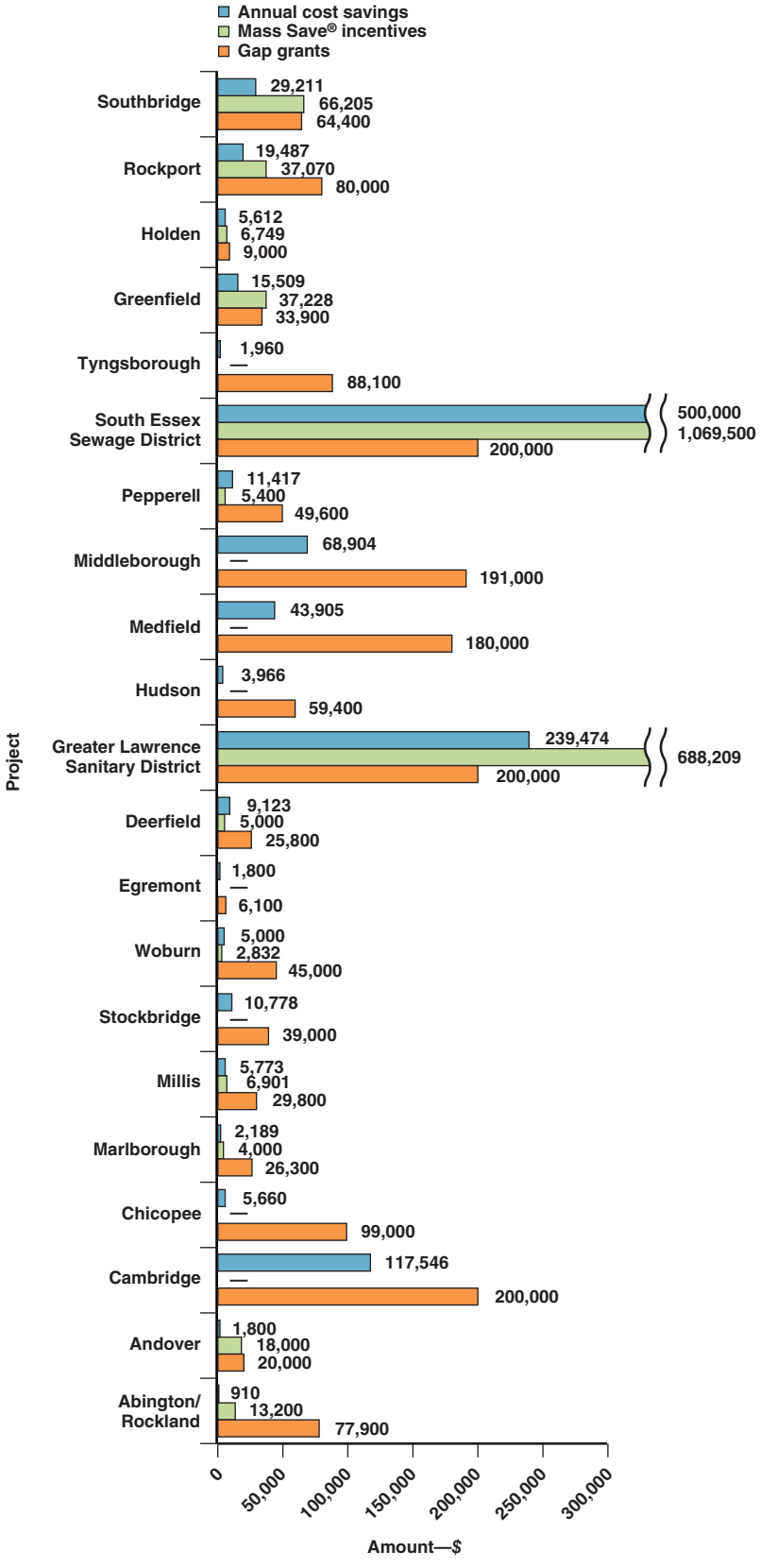


FIGURE 3 Anticipated cost savings and funding by individual project



renewables. Figure 5 highlights the anticipated electricity savings (kW·h) and electricity generation (kW·h) by the individual projects.

As noted, the implementation of energy-efficiency projects can lead to significant electrical and cost savings for water facilities. Such projects included the installation of variable frequency drives (VFDs); motor and pumping system upgrades; retrofitting of lighting systems; heating, ventilation, and air conditioning upgrades; and water and wastewater process improvements. (A *VFD*—also called an adjustable-frequency drive, variable-speed drive, AC drive, micro drive, or inverter drive—is a type of adjustable-speed drive used in electromechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage. Based on the application, VFDs can provide good electrical energy savings to customers.) Examples of energy-efficiency projects in Massachusetts follow.

The Town of Pepperell optimized its aeration system by installing automated dissolved oxygen probes that adjust its air supply for biological treatment to match incoming dissolved oxygen loads. This best management practice provides an adequate level of air without over-oxygenating the water, and it can save significant amounts of electricity.

The City of Southbridge—which treats and delivers more than 536 mgd of drinking water to 16,842 customers each year—capitalized on this grant by installing VFDs at its drinking water treatment facility as well as pumps, motors, and VFDs at its wastewater plant, saving $29,209 and 239,807 kW·h annually (see the photographs on page 52).

The Town of Stockbridge—which treats and delivers approximately 30 mgd of drinking water each year to 1,548 customers—replaced its electric space heaters with a water-source heat pump

system that uses the drinking water as a source of energy to provide heating and cooling. The system is currently saving the facility $19,600 annually (83,300 kW·h), which is a 33% reduction in its electrical budget (see the photographs on page 52).

This program funding was effectively used and distributed among different-size drinking water and wastewater facilities across Massachusetts. In addition to assisting medium and large facilities, this program provided 40% of total funding to the small drinking water facilities and 30% to small wastewater facilities (Figure 6).

This funding model grew from the eight-year Clean Energy Partnership for Drinking Water and Wastewater Facilities. Working with facilities and listening to their needs, the Partnership developed the gap funding approach to effectively leverage state agency, energy utility, and municipal money to move good energy-saving projects forward.

Massachusetts' small, medium, and large drinking water and wastewater facilities seamlessly benefited by this program—both in energy-efficiency and clean-energy development. Two examples follow.

Egremont's drinking water treatment plant, which treats .074 mgd of water in the Berkshire Hills of rural Massachusetts, is now meeting 40% of its total electrical demand through its town-owned, 10.5-kW solar clean energy project.

The City of Cambridge Water Department's Walter J. Sullivan Water Purification Facility, which delivers 14 mgd of clean water to over 100,000 residents, will reduce its annual raw water pumping electrical use by more than 1,024,000 kW·h (66%) and save the city $115,000/year. In addition, a 170-kW rooftop solar photovoltaic system is being installed that will generate another 180,000 kW·h/year, saving the city an additional $17,000.

FIGURE 4 Total electricity saved and generated

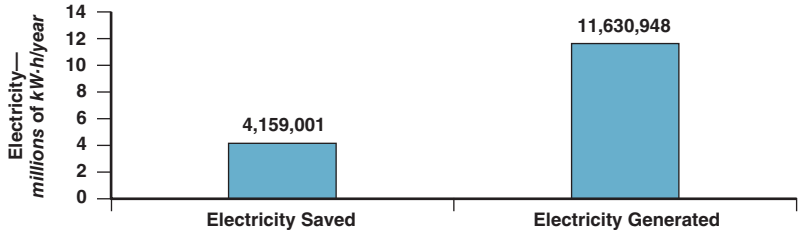
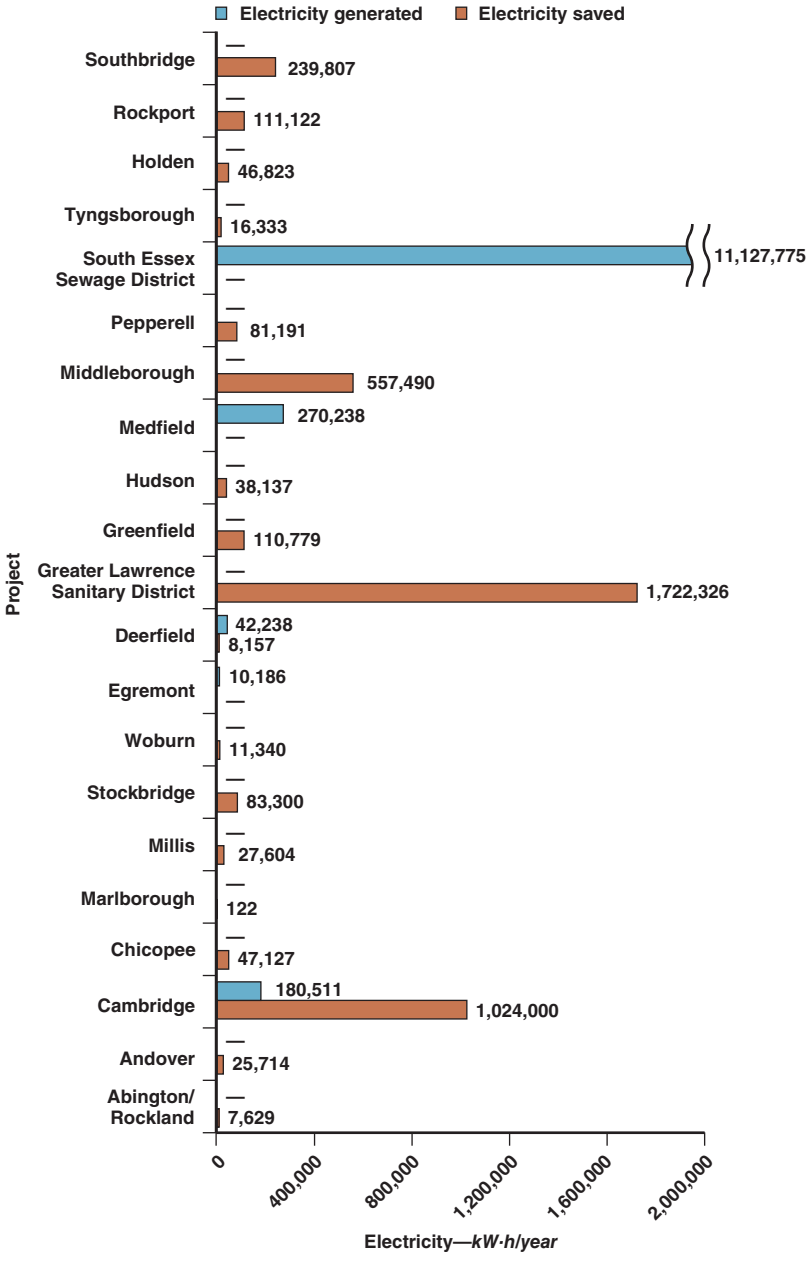


FIGURE 5 Anticipated electricity savings and generation by individual project



Clockwise from top left: Grant money was used to install new raw water pump motors at the City of Southbridge (Mass.) drinking water plant. New variable frequency drives for effluent pumps were installed at the City of Southbridge wastewater plant, saving $29,209 annually. Heather Blakeley, acting director of public works, shows off new effluent pump motors at City of Southbridge wastewater plant. Michael P. Buffoni, water superintendent for the Town of Stockbridge (Mass.), shows off the facility's new energy- and money-saving heat pump. At the Town of Stockbridge drinking water plant, a new heat pump with heat recovery ventilator is saving the facility $19,600/year.

MASSACHUSETTS' PUBLIC RETURN ON INVESTMENT

In 2016 a cost–benefit analysis of the Massachusetts gap funding program was done in partnership with AWWA and the Policy Navigation Group in Washington, D.C. (More information is available at MassDEP's Clean Energy Results Program website at www.mass.gov/eea/agencies/massdep/climate-energy/energy.) This analysis evaluated 17 of the 21 gap funding grants for reducing energy consumption at water utilities entirely through energy efficiency projects. The remaining four projects received gap funding, but they were not included in this cost–benefit analysis. Two of the grants were solely for electricity generation through solar photovoltaic installations, one grant included both efficiency projects and a solar photovoltaic installation, and one grant was for a combined heat and power project.

As shown in Figure 7, the total $2.5 million Massachusetts investment (state gap funding grants plus Mass Save) is expected to result in over $40.2 million of public benefits over the next 15 years, yielding $31.1 million of energy savings for municipal water facilities and $9.1 million of public environmental benefits. The projected cost–benefit ratio is more than 15:1, meaning that for every public dollar provided, more than $15 in public benefits should be achieved.

The gap funding grant program shows that government can cost-effectively solve problems. As a result, the economic and environmental benefits of this program were shown to be both immediate and long term. These energy cost savings and emission reductions are a great public return on investment for the Commonwealth of Massachusetts and its taxpayers. The Massachusetts gap funding model and experiences can be applied to other states interested in promoting improved energy performance at drinking water and wastewater facilities and achieving both economic and environmental results.

FIGURE 6 Distribution of gap funding grant projects by facility size

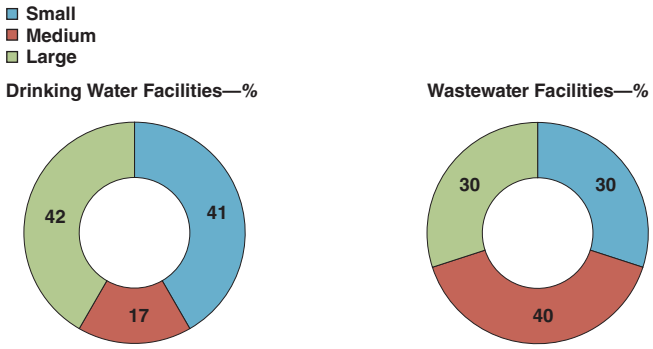
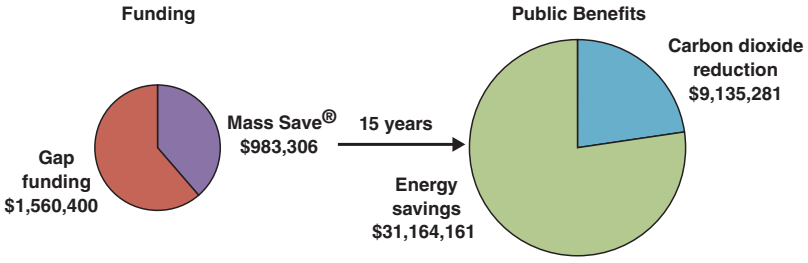


FIGURE 7 Projected public benefits from Massachusetts clean energy investments



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